Building Abusiveness in the City of Messina: Analysis of the Trend in the Years 1990-2003

Abusivismo edilizio nel Comune di Messina: Analisi dei trend negli anni 1990-2003.

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Riassunto: Nel presente articolo ci si propone di studiare il fenomeno dell'abusivismo edilizio nella città di Messina negli anni 1990-2003. Sono prese in considerazione tre tipologie di violazione edilizia: Sanzioni Amministrative, Violazioni alla Legge Urbanistica, Sequestri Edilizi. L'interesse è anche focalizzato sull'analisi del fenomeno nelle quattordici circoscrizioni. La bassa numerosità del campione e la non normalità nella distribuzione dei tre fenomeni considerati non garantiscono risultati asintotici validi, pertanto si è utilizzata, in un approccio non parametrico di permutazione, la procedura di Stochastic Ordering multivariata (tre tipi di reati) e multistrato (quattordici quartieri) al fine di verificare l'esistenza di doppio ordinamento stocastico, equivalente ad un trend positivo prima di un anno di picco (1993) e negativo nei successivi.

Keywords: trend with ties of order, stochastic ordering, year of peak, permutation test , methodology of non parametric combination, Mack-Wolfe test.

1. Introduction

The study of phenomenon of the building abusiveness assumes a value of notable interest both for the social and economic impact and for the environmental one. The foolish use of the territory, privileging the housing colonization out of the rules, determines in fact a worsening of the quality of the life, escaping them very ample territories to the natural "vocation" of development: the agriculture and the tourism. The management of the territory, in presence of a strong concentration of population, is certainly a non simple practice, that asks for manifold competences fit to appraise the correlated risks to an excess of anthropic pressure on the natural environment. The birth of new productive activities and the demographic increase have, in fact, complicated the retrieval of spaces profits to be built, for which to rationalize the use of the available spaces has become a primary demand in the direction of a sustainable development, auspicious to regulate the complex relationship between the human activities and the natural environment.
The purpose of the present job is to appraise if in the period 1990-2003 in the city of Messina the phenomenon in examination has been characterized by the presence of a possible peak. We have examined the data, noticed by the department of Environmental Police of Messina in the period 1990-2003, in relief on each of the 14 districts in which

the city is divided. We considered three violations of some articles of the Law Regional 10 August 1985, n. 37 "New norms in subject of urbanistic control of the activity - house building, rearranges urbanistic and confirmation of the unauthorized works": the first related to the articles 5 and 9 (Administrative Sanctions), the second to the article 20 (Urbanistic Law) and the third to the Building Sequestrations.

2. The methodology

The responses of the problem are quantitative (not normally distributed) X_{hqi} variables, $i = 1990,...,2003,\ \ q = 1,\ldots,14\,,\ \ h = 1,2,3\,,$ where h is the kind of violation, q is the district and i is the year.

The hypotheses under testing are

$$\begin{aligned} \mathrm{H}_0 &= \left\{ \bigcap_{h=1}^{3} \left[\bigcap_{q=1}^{14} [X_{h1990} \overset{d}{=} X_{h1991} = \ldots = X_{h2002} \overset{d}{=} X_{h2003}] \right] \right\} = \\ &= \left\{ \bigcap_{h=1}^{3} \left[\bigcap_{q=1}^{14} \mathrm{H}_{0hq} \right] \right\} = \left\{ \bigcap_{h=1}^{3} \mathrm{H}_{0h} \right\} \end{aligned} \tag{1}$$

against the alternative

$$\begin{aligned} \mathrm{H}_1 &= \left\{ \bigcup_{h=1}^{3} \left[\bigcup_{q=1}^{14} X_{h1990} \overset{d}{\leq} X_{h1991} \overset{d}{\leq} \ldots \overset{d}{\leq} X_{h1993} \overset{d}{\geq} \ldots \overset{d}{\geq} X_{h2003} \right] \right\} = \\ &= \left\{ \bigcup_{h=1}^{3} \left[\bigcup_{q=1}^{14} \mathrm{H}_{1hq} \right] \right\} = \left\{ \bigcup_{h=1}^{3} \mathrm{H}_{1hq} \right\} \end{aligned} \tag{2}$$

where at least one strict inequality is satisfied. Hence we verify the existence of a peak in the year 1993 in any district and any violation. The independence under the null hypothesis is only satisfied for the observation of the same district on different years. In this work we use a nonparametric permutation procedure as suggested in Pesarin (2001) for testing $\mathrm{H}_{0hq}\ \ q = 1,\ldots,14\,,\ \ h = 1,2,3\,.$

Combining hypotheses $\mathrm{H}_{0h} = \bigcap_{q=1}^{14} \mathrm{H}_{0hq}$ we answer to the question: "Given the violation *q*, do exist one peak in the time series in any district?". By controlling the Familywise Error Rate (FWE) for the 14 tests, we may detect the district which significantly show the peak (for a given violation). Hence we define *spatial level* this first level of the analysis. An unbiased test for the hypotheses $\mathrm{H}_{0h} = \bigcap_{q=1}^{14} \mathrm{H}_{0hq}$ is easily reached using the Nonparametric Combination Methodology (Pesarin, 2001).

In the second stage we have to combine $\mathrm{H}_0 = \bigcap_{h=1}^{3} \mathrm{H}_{0h}$ hence we identify the violation which significantly shows a peak in any districts. For this reason we define it as *temporal level*. Also in this case a multiplicity correction is needed in order to keep in account that we are dealing with many kind of violation.

3. The application on the dataset of building abusiveness in Messina

The multivariate and multistrata procedure of the Stochastic Ordering (Terpstra e Magel, 2003), equivalent to a trend with ties of order, has been applied with the purpose to verify the existence of a peak for the series, the year 1993; we have hypothesized it departing from the presupposition that the citizens of Messina would have set in to be unauthorized constructions, sure of the beneficent derivable from the already announced remission of the following year. Number of random permutation are set to 5000, the combining function for the spatial level analysis (first level) is Fisher, the combining function for the temporal level analysis (second level) is Tippett. The same analysis has been conducted through the application of the non parametric test of Mack-Wolfe (Soliani, 2004) equivalent to the verification of a trend without ties of order for each single district, with the purpose to effect a comparison among the results. The Bonferroni correction over the p-values related to the same violation allows for the temporal level analysis. In Table1 we report the results of the Mack-Wolfe test and of the Stochastic Ordering (Pesarin). The "adjusted" p-values are reported too. Correction has been performed through the procedure of Closed Testing (Marcus et al, 1976). This procedure is essential in a multivariate context because it is necessary to control the FWE, that is the probability to commit at least a multivariate error of I type, or to commit an univariate error of I type.

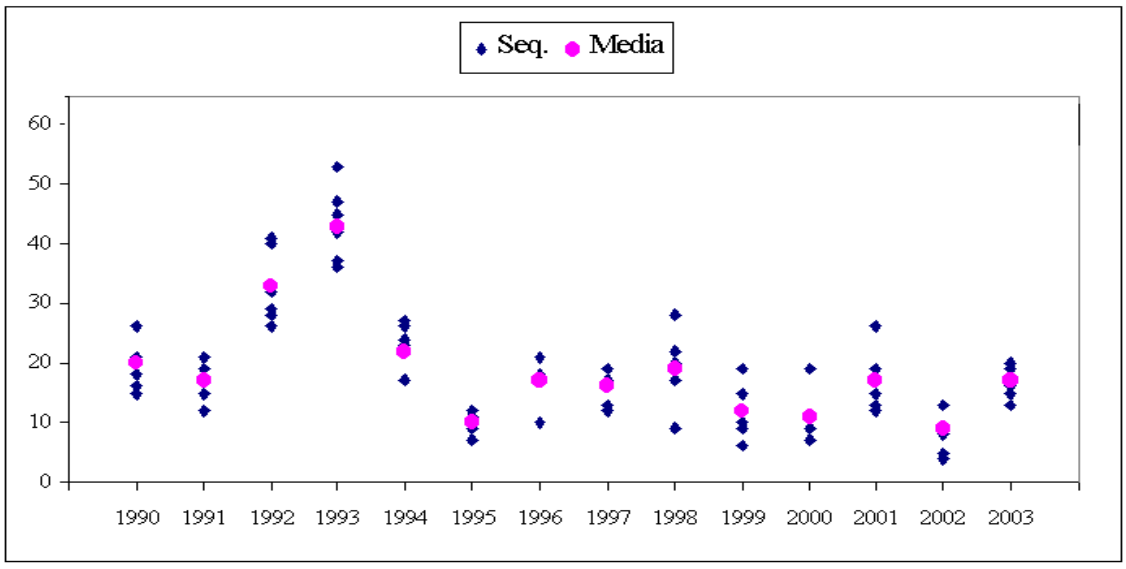
Table1: *Results of the Stochastic Ordering for the verify of the existence of the peak*

	Administrative Sanctions				Viol.to the Urbanistic Law				Building Sequestrations			
	Mack-Wolfe		Pesarin		Mack-Wolfe		Pesarin		Mack-Wolfe		Pesarin	
Distr.	Raw	Adj.	Raw	Adj.	Raw	Adj.	Raw	Adj.	Raw	Adj.	Raw	Adj.
I	0.908	1.000	0.147	0.501	**0.005**	0.060	**0.001**	**0.00**7	**0.034**	0.306	**0.008**	**0.041**
II	0.563	1.000	0.231	0.602	0.162	1.000	0.118	0.527	0.281	1.000	0.443	0.905
III	0.998	1.000	0.911	0.999	**0.006**	0.060	**0.048**	0.243	**0.022**	0.220	**0.043**	0.270
IV	0.316	1.000	0.193	0.602	0.085	0.680	0.252	0.763	**0.003**	**0.036**	**0.003**	**0.021**
V	0.098	1.000	0.089	0.454	0.316	1.000	0.134	0.527	0.900	1.000	0.074	0.299
VI	0.240	1.000	**0.007**	**0.048**	0.052	0.468	**0.006**	**0.034**	0.058	0.464	0.071	0.299
VII	0.794	1.000	0.708	0.804	0.543	1.000	0.245	0.763	0.373	1.000	0.078	0.299
VIII	0.112	1.000	0.100	0.463	0.553	1.000	0.492	0.763	0.992	1.000	0.992	0.999
IX	0.809	1.000	0.369	0.634	0.482	1.000	0.349	0.763	0.876	1.000	0.982	0.993
X	0.307	1.000	0.082	0.454	0.492	1.000	0.398	0.763	0.829	1.000	0.917	0.993
XI	0.015	0.210	**0.008**	**0.041**	**0.001**	**0.013**	**0.041**	**0.029**	**0.001**	**0.013**	**0.037**	**0.038**
XII	0.748	1.000	0.154	0.501	**0.005**	0.060	**0.015**	0.079	**0.003**	**0.036**	**0.008**	**0.041**
XIII	0.102	1.000	**0.029**	0.163	**0.000**	**0.001**	**0.002**	**0.013**	**0.000**	**0.001**	**0.012**	0.065
XIV	0.513	1.000	0.187	0.602	0.553	1.000	0.334	0.763	0.822	1.000	0.994	0.999
	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Comb	0.210	0.210	**0.001**	**0.001**	**0.014**	**0.042**	**0.001**	**0.001**	**0.014**	**0.042**	**0.001**	**0.001**

Examining the p-values for every area, we can notice that the results gotten through the tests of exchange totally confirms those gotten through the non parametric test of Mack-Wolfe; the year 1993, in fact, constitutes a real peak for the series in examination, for the district XI, relatively to the Administrative Sanctions (such as it can also deduced by the results of the non parametric test), even if for the same variable the Stochastic

Ordering also furnishes significant results for the districts VI and XIII. About the Violations to the Urbanistic Law the peak results verified, through both the methodologies, for the districts I, III, XI, XII and XIII; the Stochastic Ordering also is significant for the district VI, while the Mack-Wolfe p-value results to the limit of the significance (0.052). Finally for the Building Sequestrations we can assist to a perfect coincidence of results, in fact the year 1993 represents the peak of the series for the districts I, III, IV, XI, XII and XIII. Particularly, for the XI district (Figure1) the existence of the peak results verified for each of the three typologies of building violation in examination.

Figure 1: *Stochastic Ordering related to the Sequestrations - District XI*



5. Conclusions

The low numerousness of the champion and the not normal distribution of the three considered phenomenons led us to use the methodology of the Stochastic Ordering: together with closed testing procedure (multiplicity correction); it become an opportune tool for temporal-space analysis that has allowed us to come, in inferential way, to conclusions about both to the temporal course of the building phenomenon and the spatial dimension; in fact we have conducted the analysis stratifying for districts. Examining the modifications recorded during the examined temporal period of the inclusive years between 1990 and 2003, we can affirm that 1993 has been the year when the phenomenon of the building abusiveness in Messina has reached elevated levels, especially in peripheral districts. Numerous inhabitants of the commune, above all of the districts I, III, XI, XII and XIII realized, in that year, unauthorized constructions, certain of the beneficent derivable from the already announced remission of the following year. In this sense the legislative intervention has been conclusive in to increase the phenomenon.

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